

REMARKS

Claims 1-4, 9 and 12-13 were examined in the Office Action mailed July 25, 2006. The pending rejections include:

Section 112 Rejections: Claims 2-4 as indefinite for reciting limitations which allegedly render their independent claim inoperable, and claim 9 as lacking antecedent basis.

Section 102(b) Rejections: Claim 1 as anticipated by U.S. Patent No. 6,683,268 to Briand, *et al.* (“Briand”), by U.S. Patent No. 4,258,242 to Fujimori, *et al.* (“Fujimori”), and by U.S. Patent No. 4,320,277 to Taira, *et al.* (“Taira”).

Section 103(a) Rejections: Claims 12-13 as unpatentable over Japanese patent publication JP 410296472 (“Goto”), in view of U.S. Patent No. 6,399,915 (“Mori *et al.*”).

1. Section 112 Rejections. In response to the §112 rejections, the Applicant is requesting entry of amendments to 2-4 and 9 to recite that “the process gas is one of said binary or ternary gas mixtures” and that it is this gas which contains the recited volume fractions of carbon dioxide. It is respectfully submitted that these amendments resolves any clarity concerns, and that in view of the searches already conducted in this case, their entry may be made without additional search. In addition, the Applicant is requesting entry of an amendment to claim 9 to address the antecedent basis issue, by reciting that “the process gas further comprises comprising oxygen, and the process gas contains up to 50% by volume of carbon dioxide.” Entry of the foregoing amendments, and reconsideration and withdrawal of the § 112 rejections is respectfully requested.

2. The § 102 Rejection Based On Briand Has Been Rendered Moot.

The Applicant is submitting under separate cover certified English translations of the two German documents to which priority is claimed, in order to perfect the Applicant's claim to priority and thereby establish that the Briand reference is not effective against the present Application. Withdrawal of the pending § 102(b) rejection based on Briand is respectfully requested.

3. Reconsideration of the Remaining Rejections Is Requested.

The Applicant respectfully requests reconsideration and withdrawal of the rejections based on the Fujimori, Taira, Goto and Mori references.

In the pending rejections, the Examiner has identified references teaching use of specific process gases in *arc-welding* processes as disclosing or rendering obvious the claimed laser-welding processes. Inherent in these rejections is an assumption, respectfully noted as being unsupported in the record and inconsistent with the knowledge of those skilled in the art, that arc-welding and laser-welding are so similar that their process gases may be freely interchanged.

The Applicant respectfully submits that this assumption is not correct, that the claimed laser-welding process would not result from the mere substitution of a laser for the arc-welding equipment in the cited references, and there is not basis for the assertion that these arc-welding processes disclose or suggest the claimed laser-welding process, in no small part because the chemical reactions occurring in the process gases near the weld, and specifically at the gas/welding target interface, are highly temperature- and constituent-dependent, both of these parameters being markedly different between arc-and laser-

welding. Accordingly, a process gas suitable for one type of welding may be wholly unsuitable for the other, and absent a specific teaching to the contrary, it cannot be assumed that an arc-welding process gas will behave in anything approaching a similar manner in a laser-welding application.

The primary reason that arc-welding and laser-welding processes are not freely interchangeable is that the welding energy deposition is performed in fundamentally different ways in the two processes, resulting in very different process gas interactions with other materials, themselves, and the welding-energy source.

In arc-welding, one of ordinary skill is aware that it is relatively easy to get deep energy penetration into the weld zone due to the high power – power so high that the arc must be stabilized, and process gases must be selected to provide controlled, desired chemical reactions in and around the highly ionized gas and workpiece constituent elements. In the case of arc-welding, the process gases not only do not interfere with arc energy deposition, they frequently assist with maintaining the arc (*i.e.*, by providing an ionizing medium to help conduct the arc energy to the weld target).

In contrast, unlike in arc-welding, lasers deposit energy in a weld zone in a very small area, and are not known to provide deep penetration and good welds, especially in non-ferrous metallic welding. This is due at least in part to the fundamental difference in the energy deposition mechanism, *e.g.*, arc-welding's far greater internal heating by movement of electrons deeply through the target material vs. surface heating by absorption of laser light energy only at

the target surface. The difference in heat deposition is compounded by the diffusion and reflection of the laser light beam by the process gas molecules and by reflection from the metallic work surface, issues not a consideration in arc-welding. *See generally* background discussion, Specification ¶¶ [0004]-[0012].

This problem with inadequate weld zone heating due to laser light deflection is particularly acute in welding processes which require deep penetration, because chemical reactions at the point of welding (at least with previous gas compositions) are known to generate gas byproducts deep within the narrow, poorly-ventilated weld groove which can absorb, reflect and otherwise interfere with (and sometimes even block) laser light transit to the weld point. Such interferences play a significant role in why previous attempts to use a relatively-low energy laser diode to perform laser welding in non-ferrous metallic workpieces with previously-known process gases typically have not been successful. *Id.* at ¶ [0012].

Further, the different welding processes require different process gas compositions due their very different heat-transfer characteristics (a consequence of their different energy deposition approaches). For example, due to the very different temperature distributions between a high energy arc (reflected post-weld in its very broad heat-affected zone) and a narrowly-focused laser (small heat-affected zone), the very different temperatures at and near the weld zones significantly alter the amount and nature of the chemical reactions occurring, both within the different process gases, and between the gases and the target material.

The Applicant respectfully submits that one of ordinary skill in the art, being well aware of the fundamental differences in process gas interaction with the target material, with the constituents of the gas itself, and the laser beam, would immediately recognize that: (i) *no* arc-welding process gas can be "assumed" to be equally suitable for use with a lower-powered laser diode welding process, *i.e.*, that a laser cannot be "dropped in" as a substitute for a welding arc with any reasonable expectation of obtaining a satisfactory weld product; and (ii) the behavior of a process gas in the vicinity of an welding arc and in the vicinity of a laser weld point are so different that arc-welding processes neither disclose, nor provide any credible suggestion of, a laser-welding process gas composition.

In view of the foregoing, the Applicant submits that the cited arc-welding references cannot, and do not, disclose or suggest the claimed laser-welding process. The Applicant therefore respectfully requests the pending rejections based on these references be reconsidered and withdrawn

CONCLUSION

In view of the foregoing, the Applicant respectfully submits that the pending claims are in condition for allowance. Early and favorable consideration and issuance of a Notice of Allowance for these claims is respectfully requested.

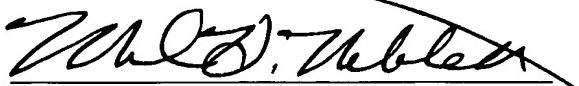
If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

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PATENT

If necessary to effect a timely response, this paper should be considered as
a petition for an Extension of Time sufficient to effect a timely response, and
please charge any deficiency in fees or credit any overpayments to Deposit
Account No. 05-1323 (Docket #038724.52699US).

Respectfully submitted,

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